Bruce McDannold
Election Systems Division
Office of the Secretary of State
1500 11th Street
Sacramento CA 95814

7 Jun 2005

Subject: Certification of ES&S AutoMark Voting System Version 1.0 Introducing the AutoMARK Technical Services' (ATS) AutoMARK Voter Assist Terminal (VAT) Release Ver. 1.0 In Conjunction with the ES&S Unity 2.4.3 Election Management System and Selected Optical Scanners.

Executive Summary

State certification testing was conducted 19-25 May 2005, in Omaha, Nebraska, to certify the ES&S AutoMark Voting System Version 1.0 which consists of previously certified Unity 2.4.3 components supplemented with the AutoMARK Voter.Assist Terminal (VAT) Release Ver. 1.0.

The AutoMARK VAT is a stand-alone device that provides voters assistance in marking optical scan ballots. Assistance is provided to meet HAVA requirements for voters with disabilities as well as providing DRE style voting support for voters without disabilities. The AutoMARK is expected to be used in polling places to supplement standard optical scan ballot voting where voters may require assistance.

For this certification, the operation of the AutoMark is confirmed against ES&S Unity 2.4.3 Election Management System and the M100, M550, and M650 ballot scanners, which have been previously certified in California.

Review and testing of this proposed configuration showed compliance with the California Election Code with the following caveats and recommendations

a. The NASED certification has not yet been approved.
b. Some disabled voters may have difficulty handling the ballot or viewing through magnifying lens.
c. Security recommendations from earlier ES&S certifications such as tamperproof seals on compartments and ports are still applicable, A seal on the ballot definition Compact Flash card or compartment is also recommended.

.

References:

1. [M650] Wyle Report# 48489-03, *Change Release Report of the ESS Model 650 Mark-Sense Central Ballot Counter (Firmware Release 1.2.0.0),* 24 Feb 04.
2. [M550] Wyle Letter# 48489B-22, *ITA Hardware Qualification Testing of the ESS Model 150/550 Central Ballot Counter, Firmware Release 2.1.1.0, 18* Aug 04.
3. [Unity2] Ciber Report, *Election Systems and Software International (ES&S) Software Qualification Test Report, Amendment 2, Unity 2.4.3 Updates for 1990*, 27 Aug 04.
4. [SysTest] SysTest Draft Report, *Hardware Qualification Report For the AutomarkTechnical Systems' ES&S AutoMARK Voting System Verison 1,0*, Rev 00, June 1, 2005
5. [Ciber] Ciber Draft Report, *AutoMark Technical Systems Software Qualification Test Report*, 5/27/05
6. [CalSOSUse] ES&S/ATS, *ES&S AutoMARK™ California Election Procedures Manual for the AutoMARK Voter Assist Terminal*, created 5/23/05.

Introduction

In compliance with California Election Code, Election Systems and Software (ES&S) applied for certification for the ES&S AutoMARK Voting System which consists of the following components:

1. ES&S, Unity 2.4.3,
    a. Audit Manager (AM) v. 7.0.2.0
    b. Election Data Manager (EDM) v. 7.2.1.0
    c. ES&S Ballot Image Manager (ESSIM/BIM) v. 7.2.0.0
    d. Hardware Programming Manager (HPM) v. 5.0.3.0
    e. Election Reporting Manager (ERM) v. 6.4.3.0
2. ES&S M100 Optical Scan Precinct Counter, Firmware Ver. 5.0.0.0
3. ES&S, M550 Central Ballot Counter, Firmware Ver 2.1.1.0
4. ES&S, M650 Central Ballot Counter, Firmware Ver 1.2.0.0
5. ATS, AutoMARK Information Management System (AIMS), Rel. 1.0.9
6. ATS, AutoMARK Voter Assist Terminal (VAT) Rel Ver. 1.0.

(Attachment A has equipment specifications for the Test Configuration)

"The AutoMARK Voter Assist Terminal (VAT) [added:svf] release version 1.0 is a touch screen monitor with a built-in printer that marks a pre-printed oval or arrow ballot. A voter inserts a blank pre-printed ballot into the VAT. The voter accesses a visual and/or audio ballot in a voter selected language. They vote via any of three methods: a touch screen, tactile buttons or an alternative entry binary logic stereo jack input device [such as 'sip 'n puff'' or foot pedals for the physically disabled: added-svf]. The ballot interface performs the functionality of a DRE prior to printing the ballot. The AutoMARK Voter Assist Terminal provides a summary of the voter's selections for review, allowing the voter to confirm selections and cast the ballot, using a built-in printer. The printer can be used to print on both sides of the ballot. Once a ballot has been marked and printed, the Voter Assist Terminal ejects the paper ballot. No votes are stored in memory." [SysTest]

.

AIMS provides support needed to import election definitions and ballot layout information from the ES&S Unity or to manually define or adjust the ballot layout information based on the actual printed ballots. The Unity 2.4.3 and subject scanners have been previous certified in California and this testing did not materially retest these components other than confirming and setting up the election database for loading to the AIMS and counting ballots marked by the AutoMARK. This test was conducted in parallel with certification testing of the Unity 2.4.3 system for Oregon; some observations from that test applicable to California are included in this report

Unity is a suite of integrated programs which can be installed to support the specific ballot counters needed by the election jurisdiction. Three of ES&S optical scan ballot scanners were tested for compatibility with AutoMARK and used ballot definitions produced by Unity. The tested configuration was for three of the optical counters but excluded:

a. the Model 150 Central Ballot Counter,
b. the iVotronic Touch Screen DRE Voting System,
c. the Optech III-P Eagle Precinct Counter,
d. the Optech IV-C Central Counter
e. the following Unity 2.4.3 modules
    i. Data Acquisition Manager (DAM)
    ii. iVotronics Ballot Image Manager (IM),
    iii. Optech Image Manager (OIM)
    iv. Ballot On Line (BOL)

.

Qualifications

NASED Certification

1. N-1-02-21-21-002 (1990), 27 Aug 2004
    a. Unity 2.4.3
        i. Audit Manager (AM), v.7.0.2.0 (not used in test)
        ii. Election Data Manager (EDM) v. 7.2.1.0,

iii. ESS Image Manager (ESSIM) v. 7.2.0.0.
iv. Optech Image Manager (OIM) v. (not used in test)
v. Hardware Programming Manager (HPM) v. 5.0.3.0,
vi. Election Reporting Manager (ERM) v. 6.4.3.0

b. Model 150/550 v. 2.1.0.0 M
c. Model 650 v. 1.2.0.0

2. (Pending NASED Certification) for AutoMARK.
a. AutoMARK Firmware Version 1.0.168
b. AutoMark Information Management System (AIMS) Ver 1.0.9

Draft reports for the NASED ITA testing of the ES&S AutoMARK Voting System have been delivered and are under review by the NASED Technical Committee. Copies of the draft reports were available for preparing this report but do not satisfy official requirements for certification. Changes in the final reports may require revision or supplementing this report. If the reports are approved, a NASED number will be assigned indicating the qualification of the system.

Test Results

The test election was based on a standardized California 2004 Test Primary and General which combined actual contests and candidates from recent California elections. The test elections consisted of five precincts, one with a split, and samples of typical races for different levels of districts that occur in California with basic contest logic variations. For the Primary, ballots for seven political parties and the 'decline to state' ballots for the American Independent Party, the Democratic Party, and the Republican party were included. (See Attachment B for a summary of the test deck). A Logic and Accuracy (L&A) type deck was prepared with every candidate and proposition choice receiving one or more votes in every ballot they appear; this deck was used to verify the readiness of the optical ballot scanners and the completeness of the election definition. (Minor errors were noted in the test election definition and predicted results adjusted to correct for the errors).

Additional ballots were prepared using the AutoMARK to vote, repeating much of the critical logic of the L&A deck but also exercising the operation of the AutoMARK and its response to common voter actions and errors such as skipping contests and going back. Trilingual ballots (English, Spanish, and Chinese) were used in the testing. Both audio ballots and control through a foot pedal were exercised to check support and functionality for disabled voters. The ballots from the AutoMARK were scanned by a M100, a M550, and a M650 optical scan ballot counters to verify that the AutoMARK marked ballots were correctly marked and tallied by the ES&S scanners.

Observations

Indeterminate Marks. During initial Oregon testing conducted in parallel with this testing, the test deck was marked with pencils and pens similar to what is used in many mail-in ballots. The initial scanning of the ballots on the M150, M550, and M650s failed to recognize legitimate marks or reported them as being marginal requiring human review. Using a built-in calibration test tool, we were able to identify the ballots counters were out of tune and had them readjusted into specification. When the ballots were reread, the votes were correctly read or identified as marginal markings requiring human review. The incident demonstrated the need to test the counters before the election (and ideally afterwards) to check the readiness of the ballot counters for the election. (ES&S was asked to provide procedures and materials for conducting pre-election calibration checks in the California use procedures during the previous certification on these devices.) The AutoMARK ballots provided clear, consistent markings free from indeterminate markings but the calibration check procedures should still be conducted to support the hand marked ballots cast within the polling place or by absentee.

Problems with unrecognizable characters in language translations. The test ballots used included bilingual and trilingual ballots—that is, ballots that display two and three languages. When the ballot layout information is transferred to AIMS, the import operation has problems with certain

common fields (write-in and occupation labels) that combine two or more languages. As a result, the AIMS programmer has to enter in and manually change all the effected fields in the ballot. The necessary step is fairly quick but may be an issue in a large election involving hundreds of ballot layouts. Programming and verifying should be scheduled with some leeway for the extra editing should it be necessary. ATS is expecting to eliminate this problem in a later version.

Ballot system proofing and verification. For verification of the ballot definitions used in the election, a system proofing procedure is available using the Print Calibration test where a blank ballot is read by the AutoMARK in Test mode and the AutoMARK prints test marks in each vote target position as well as overwriting the candidate or measure response to show what position was being voted. This step should be specified in the California Use procedures as part of the system proofing with guidance for retention of the proof ballots for the official audit record. The overprint of the candidate name during the test was faint but adequate to verify the reading of the ballot positions is correctly assigned to the appropriate contest and candidate.

Slow operations limiting use. The VAT is not designed for large volume voting. The ballot reading, touch screen operation, ballot marking, and final return of the marked ballot are slow with a noticeable delay before printing (marking the ballot) starts and the final marked ballot is returned to the voter. On larger ballots, the delay can extend into minutes. Times recorded:

Unmarked ballot returned to voter:	30 sec to <1 minute
Simple marked ballots:	1-2 minutes
Most complex ballot used in test:	2-6 minutes
Audio	4-7 minutes (after tester became use to the audio)

(These timed tests were with scripted votes and do not necessarily reflect a common voter response time).

The use of confirmation screens warning voters that they didn't vote or didn't scroll up/down to see the entire contest added to the slow operations, especially for audio voters who wish to skip through contests. For small numbers of voters using the system, these delays should be acceptable

Need for security sleeves. The ballot, once marked, is returned to the voter who may then reread it to verify the ballot, load it into a precinct counter, or drop it in a ballot box. During the transition from VAT to ballot box, the ballot may need to be inserted into a security sleeve to ensure the voter's choices are not revealed.

Ballot handling for voters who cannot physically manage ballots. Use of the VAT requires a voter to place the blank ballot into the ballot read slot and, after marking the ballot, removing the ballot then transfer it to a ballot box or ballot scanner to deposit. Those voters requiring the use of ADA devices such as the sip and puff or foot pedal will require assistance handling the ballot that could jeopardize the secrecy of their vote with out thoughtful procedures.

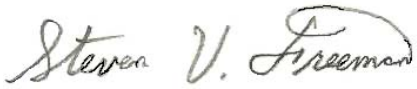
Security locks. The lock on the Compact Flash compartment is not necessarily uniquely keyed. Even if the keys are replaced with unique keys, tamper proof seals are recommended to provide proof the compartment was not entered or tampered with during the election.

Conclusion

Review and testing of this proposed configuration showed compliance with the California Election Code with the following caveats and recommendations

a. The NASED certification has not yet been approved.
b. Some disabled voters may have difficulty handling the ballot or viewing through magnifying lens.
c. Security recommendations from earlier ES&S certifications such as tamperproof seals on compartments and ports are still applicable, A seal on the ballot definition Compact Flash card or compartment is also recommended.

Sincerely,



Steven V. Freeman

Two Attachments:

A. Hardware Description with a list of the test configuration components.
B. Test Election Design

Attachment A.

Hardware Description

The AutoMARK packs up into a single unit about the size of a small suitcase and is set up on a table top. The unit is equipped with a touch screen, a keyed control switch (not displayed), a Compact Flash port for installing ballot definition files (Figure 2), and an ADA compliant touch pad. At the base of the touch pad is a set of ports (shown below) with two audio ports (supporting two common audio formats for headphones), and a RJ-45 type connector for binary control devices such as sip and puff or a foot pedal. (The fourth port is intended for future use and is currently undefined.)

In operation, the ballot definitions are installed on a Compact Flash generated by the AIMS program from imported files from Unity or by direct coding from samples of the printed ballots. The Compact Flash card is inserted in the slot in the second figure above, and the panel is closed and locked with a key. Another key (removable) controls the operation to turn the device on and switch it between test and election modes. Both keys are removed during elections. The voter, once the device is enabled inserts a printed unvoted ballot into a feed slot below the touch screen and the device reads the ballot, checking both sides, to determine if the ballot is valid for this election and which precinct/ballot style has been presented. Once the device recognizes the ballot, the voter can use the touch screen to make his/her choices and review the choices before approving the ballot to be printed. The AutoMARK then prints marks on the ballot (the printer can print both sides). The ballot is returned to the voter who can then verify it and deposit the ballot in the ballot box or in an available precinct counter.

An additional option is available to verify the ballot. The voter can reinsert the ballot. If the ballot is marked, the voter can not remark or add other marks but will be given a chance to verify how the ballot is marked.

Test Configuration

1. Unity Server
    a. Model and Serial Number: Dell D600 Latitude laptop, Dell #: 2K79071
    b. Processor: Intel Pentium 4 1.6M Hertz
    c. Memory: 1024 Mbytes installed
    d. Operating System: Windows XP, Service Pack 1 w Service Pack 2 patches
    e. Hard Drive: 39 GBytes

f. Other drives:
    i. Dell Floppy Drive Mobile 3.5 Diskette, PH038830-87606 51D NOA4
    ii. Removable CD-R/DVD Drive module, Philips CDRW/DVD CDD5263
    iii. Iomega 250 Zip Drive (USB) (S/N1GJR1480GF)
    iv. Omni USB LF Professional,PCMCIA Card Reader/Writer (S/N 541-USBLF)
    v. SanDisk ImageMate CF (CSB) SDDR-91 S/N 387273
    vi. EMP-11 Ver 1.2 Eraseable Electronic Programmable Read Only Memory (EEPROM) reader/writer.
g. Printer: HP LaserJet 1320 PCL 6, S/N CNDC5305A6
h. Display: Laptop
i. Keyboard: Laptop
j. Mouse: ATI Touchpad/optional bus mouse
k. Communication Ports:
    i. Internal Modem Conexant D480 MDC V.9x Modem. Not used for testing
    ii. Ethernet port. Broadcom 570x Gigabit Integrated Controller. Not used for testing
l. Application Software
    i. Unity 2.4.3,
        1) Audit Manager
        2) Election Data Manager
        3) ES&S Ballot Image Manager
        4) Optech Image Manager
        5) Hardware Program Manager
        6) Election Reporting Manager
    ii. AutoMark Information Management System (AIMS)
m. COTS Software:
    i. Codebase 6.5, revision 3 (MDAO compatible database)
    ii. Adobe Acrobat Standard 5.0.5 with Distiller/PDFMaker options installed.
    iii. Adobe Type File Manager 4.1 with Adobe Type Basic 65 (to load required fonts such as Helvitica).
    iv. MS Access, XP Version
    v. MS SQL Server (MSDE), Ver 2000, SP3.
    vi. RMCobol 7.50.01,
    vii. COBOL WOW 3.12.00,
    viii. OmniDrive USB Driver Ver 1.2.0.1,
    ix. USB Drive version 1.72
    x. Needham driver for the EEPROM Memory Programmer Pro -11.
    xi. Iomega Zip Disk (USB-250MB) ver 3.2.1.5
    xii. Java 2, Rel 1.4.2_3
    xiii. Symanetic Norton Security Center 2005.1/Anti-Virus 11.0.2 with AutoProtect enabled
    xiv. WinZip 9.0 SR-1

2. ES&S Optical Scan Ballot Counters
    a. Model and Serial Number: M100 Precinct Ballot Counter, S/N 203A2025401
    b. Model and Serial Number: M550 Central Ballot Counter, S/N 90476163
    c. Model and Serial Number: M650 Central Ballot Counter, S/N 7003
3. AutoMARK Voter Assist Terminals (VAT):
    a. Units:
        i. VAT, S/N ENG-016
        ii. VAT, S/N ENG-022 (configured for OpTech ballots, not used)
        iii. VAT, S/N ENG-036
    b. Operating System: Windows CE 5.0.140
    c. ADA support equipment:
        i. Stereo headphones attached with two common audio standards audio jacks.
        ii. Braille coded/shape defined touch pad.

iii. Binary jack serial interface that permits a number of ADA devices which the voter is comfortable with using to be attached
1) Tested with a foot pedal.

Further Observation details

1. Marginal Marks/calibration (Updated from the original report on Unity 2.4.3 and M150/550/650 ballot counters)
   a. Mark sense systems which depend on human voters marking the ballot with ink or pencil are vulnerable to marks which are not clearly valid (such as a filled in oval) or not countable (a dot created where the voter tapped the pencil against the ballot target area). The class of marks between the always accepted and always ignored are sometimes called "marginal marks' and have the undesirable feature of not always being counted the same way (equivalent to hanging chad). Most of the optical scan systems in use today have very low incidences of marginal marks and a common situation is for the variation due to marginal marks to be less than the human error in manual recounts of paper ballots.
   b. The ES&S optical mark reader ballot counters have two features that work to take positive control of the marginal mark problem. With this change, the ballot counters will halt on ballots with marginal marks (identified as "indeterminate marks") and require resolution. A calibration report is available that will show which marks are positive, which are below acceptance standards, and which require human review to determine voter intent (is the marginal mark consistent with the way the voter marked other races?).
   c. During the initial (Oregon) testing, one to five ballots, depending on the ballot counter used, failed to read all the marks correctly. The most common problem was with those marked with a BIC pen. Most of the missing marks were caught and identified by the 'indeterminate mark' test but a few were processed incorrectly as not voted. The Calibration report showed that the counters were not tuned to specification and technicians were able to readjust the machines to the point that all but a few truly marginal marks were recognized and counted and the marginal marks were identified by the 'indeterminate mark' feature.
   d. No problems were noted with the recalibrated ES&S scanners for the AutoMARK ballots. The AutoMARK ballots print a clear and unambiguous mark and can be expected to be relatively free from this problem. Problems may be encountered if (1) the printing is light due to printer problems on the AutoMARK, (2) recommended printing calibration is not performed prior to use in an election on the AutoMARK, and (3) the ES&S ballot scanners are out of specification. Of the three, calibration of the AutoMARK is the most critical and should be routinely included in the use procedures for this equipment during pre-election preparations. The AutoMARK itself runs a calibration check on its markings and will reject ballots that are out of specification on the marking. During ITA testing, these rejected ballots were checked against the optical scanners and were all correctly read on the optical scanners; the AutoMARK marking criteria is substantially more stringent than that required by the scanners.
2. Language Text.
   a. One contest was set up to test system responses to long text labels to confirm that the labels exceeding internal limits do not cause critical failures (buffer overflow) and are properly displayed. No significant problem was noted but the system response in some cases was to compress the characters to fit within the space of the original ballots. The compression was vertical and made some of the more severe examples unreadable. In the AIMS, the need to preserve the vote position prohibits expanding the space for a field so this approach is reasonable. However, in an actual election, if the problem occurs, the actual text message may need to be recomposed or reformatted to provide a practical, readable display of the ballot.
   b. Unrecognizable characters. The problem on transferring the ballot definition with the dual/trilingual ballots was attributed more to the translation program used to generate the label fields affected. The translation included some formatting\control characters and special characters (an italicized slash '\' for example) that were not recognizable by AIMS. An alternative to editing every field is to download an Excel spreadsheet formatted list of text

labels and submit them to a translating service that translates and reformats the text for inclusion.

c. There was considerable flexibility within AIMS for handling alternate languages; the problems noted are more an issue for scheduling the time to handle translations and formatting issues which may be necessary and proofing the alteration between the ballot layout (from an actual printed ballot) to the AIMS display. To solve some of the problems, the actual text may need to be changed and approved for the AIMS displayed text.

Attachment B.

Test Election Design

Precinct	1	2		3	4	5
Split		1	2			
Presidential	x	x	x	x	x	x
Federal,STATE, CORT	x	x	x	x	x	x
Board of Equal 3	x	x	x	x	x	x
CONGRESS 49	x	x	x			
CONGRESS 50				x	x	
CONGRESS 51						x
STATE SENATE 35	x					x
STATE SENATE 37		x				
STATE SENATE 39				x		
ASSEMBLY 66	x					
ASSEMBLY 74		x	x			
ASSEMBLY 75				x		
ASSEMBLY 76					x	
ASSEMBLY 77						x
COUNTY, Unincorporated		x				
CHULA VISTA			x			
LEMON GROVE	x					
PORTER VISTA					x	

Political Parties	*Abbrev.*	*Major*	*Minor*	*DTS*
American Independent	AI		x	X
Democrat	DEM	x		X
Green	GRN		x	
Libertarian	LIB		x	
Natural Law	NL		x	
Peace & Freedom	PF		x	
Republican	REP	x		X, except Presidential race

Languages:

English, used in bilingual and trilingual ballots
Spanish, used in bilingual and trilingual ballots
Chinese, used in trilingual ballots
(Spanish, Chinese, Korean, Japanese, Vietnamese, Tagalog, and Creole were tested in ITA testing)